T Level Technical Qualification in Engineering and Manufacturing – Manufacturing, Processing and Control

8713-333 Composites Technologies

Grade standard exemplification material

Pass - summer 2024

Version 1-0

Version and date	Change detail	Section	Question
v1-0 Oct 2024			

Contents

Introduction

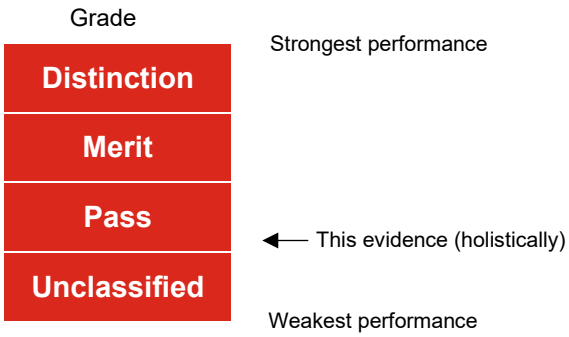
Summer 2024 Results

This document is aimed at providers and learners to help understand the standard that was required in the summer 2024 assessment series to achieve a pass grade for the 8713-333 Composites Technologies Occupational Specialism (OS)

The grade standard exemplification evidence (Grade SEM) provided for the pass grade displays the holistic standard required across the tasks to achieve the pass grade boundary in the summer 2024 series.

The aim of these materials is to provide examples of knowledge, skills and understanding that attested to **two marks above** pass standard (threshold competence) in summer 2024. It is important to note that in live assessments a candidate's performance is very likely to exhibit a spikey profile and standard of performance will vary across tasks.

The Occupational Specialism is graded Distinction, Merit, Pass or Unclassified.



The pass grade boundary is based on a synoptic mark across all tasks. The materials in this Grade SEM are separated into two sections as described below. Materials are presented against a number of tasks from the assignment.

Tasks

This section details the tasks that the candidate has been asked to carry out. What needs to be submitted for marking and any additional evidence required including any photograph/video evidence. Candidate evidence that was or was not included in this Grade SEM has also been identified within this section.

In this Grade SEM there is candidate evidence from:

Task 1 Planning
Task 2A Preparing the mould
Task 2B Production of the wing section components
Task 2C Assembly
Task 3A Defect identification
Task 3B Quality review and recording
Task 3C Handover

Candidate evidence

This section includes exemplars of candidate work, photographs of the work in production (or completed) and practical observation records of the assessment completed by provider assessors. This was evidence that was captured as part of the assessment and then internally marked by the provider assessor.

The Occupational Specialism brief and tasks can be downloaded from here.

Important things to note:

- We discussed the approach to standard setting/maintaining with Ofqual and the other awarding organisations before awarding this year. We have agreed to take account of the newness of qualifications in how we award this year to recognise that students and teachers are less familiar with the assessments (grading-arrangements-for-vtqsand-technical-qualifications-within-t-levels-in-the-academic-year-2023-to-2024), whilst also recognising the standards required for these qualifications.

- The evidence presented, as a whole, was **two marks** above the pass grade. However, performance across the tasks may vary (i.e. some tasks completed to a higher/lower standard than pass grade).

Grade descriptors

To achieve a pass (threshold competence), a candidate will be able to:

Interpret information, plan, assess risk and follow safe working methods when applying practical skills to an acceptable standard in response to the requirements of the brief.

Adequately prepare working areas, acknowledging potential risks and applying acceptable housekeeping techniques during tasks.

Demonstrate basic technical practical skills in preparing moulds, shaping composite materials and cores, laying-up, debulking, consolidating, curing and de-moulding, assembling and finishing that are in line with industry standards and meet the requirements of the brief.

Adequately demonstrate ability to follow laminating and assembly procedures to produce composite components to meet the requirements of the brief.

Demonstrate basic knowledge and understanding of the principles and processes required for composite engineering to produce a product that meets the required tolerances within the brief.

Work safely showing an understanding in the selection and use of relevant tools and equipment and demonstrate a basic awareness of straightforward preparation and application processes within the working environments for preparing moulds, shaping composite materials and cores, laying-up, debulking, consolidating, curing and de-moulding, assembling and finishing composite assemblies.

Identify causes of problems or common issues related to production control, operating procedures and quality control and have some knowledge and skills in how to rectify them.

Mostly use general industry and technical terminology accurately across different communication methods with some consideration of technical and non-technical audiences.

Task 1 Planning

Assessment number (eg 1234-033)	8713-333
Assessment title	Composites Technologies Occupational Specialism

Candidate name	<first name> <surname>
City & Guilds candidate No.	ABC1234

Provider name	<provider name>
City & Guilds provider No.	999999a

Task(s)	1
Evidence title / description	Resource list Completed risk assessment Method statement Quality check sheet template
Date submitted by candidate	DD/MM/YY

Task 1

Assessment themes:

- Health and safety
- Planning and preparation
- Production
- Quality review and evaluation

1 – Planning
You must:

- produce a resource list, with justifications for selections
- produce and complete a risk assessment
- create a method statement with justifications
- produce a quality check sheet (for use in task 3B)
- carry out calibration checks on equipment (record results on resource list)

Additional evidence of your performance that must be captured for marking:
N/A

Candidate evidence

Wing Section Assembly

Task

To create a Composite Wing Assembly that provides a method statement, risk assessment and a quality check sheet.

PPE

For this task you are required to wear the correct PPE which includes:

- Overalls

This is to stop any resin, or materials getting on your clothes and protects your body from chemicals

- Goggles

To stop any materials or liquids damaging your eyes.

- Nitilic gloves

The rubber gloves protect your skin from any chemicals

- Cut Proof Gloves

Prevents any sharp materials or tools cutting into your skin.

- Face mask

So, you don’t breathe in any materials or small fibers.

Risk Assessment

The danger that you may face when going through this process can consist of fumes, cuts, heavy weights and skin irritation. Fumes could occur when there’s a rapid thermal expansion using resin. The best thing to do is place the pot of resin or tub under a suction bench so you don’t breathe in any fumes. Cuts can be very common if you are not using the right PPE, make sure to wear cut proof gloves and hold any sharp objects correctly to not in danger you or anyone else. Heavy objects might cause you to fall over or for that object to fall on you. Ensure that all heavy objects are not in risk of falling and don’t try to lift something too heavy for you. Skin irritation can form when resin or materials come in contact with your skin. Always wear gloves in he right circumstances or if your skin can become irritated.

Tool List

To assemble the part tools are required and you need to know which tools you are going to need to create the Wing Assembly which includes the following:

- Scissors

For cutting up your materials

- Scalpel

Removing any loose fibers and cutting

- Metal Rule

Measuring out your materials to meet the brief

- Knerkers

To remove any air pockets from your material

- Tape

To place on your material to draw lines so you know where to cut

- Pen / Marker

For drawing lines to cut

- Scale

For measuring the right amount of resin

- Cardboard Cup

For mixing the resin together

Material List

Method Statement

To begin with make sure you have acquired the right PPE, Materials and Tools as shown above. If you have acquired all of this begin with this process:

Cut out two pieces of foam of identical size with the width of 120mm and the length 170mm with a hight of 20mm. You can judge the size of your foam to the mould is there is on provided. Start trimming down the foam to size to fit the mould or the parts description.

Once you have cut out both pieces of foam you can begin to cut out your material. You will need to cut eight separate pieces of carbon fibre with different orientation (90 degree, -45 degrees etc.) You can use tape and a pen to draw lines on the carbon fibre to get the proper

measurements ready to be placed on the foam. Use this tick sheet twice for each side of the part.

PLY NO	Orientation	WHERE TO PLACE	TICK BOX ONE	TICK BOX TWO
1	90 Degrees	ALL OVER PRODUCT		
2	Debulk	--		
3	+ 45 degrees	ALL OVER PRODUCT		
4	- 45 Degrees	ALL OVER PRODUCT		
5	Debulk	--		
6	90 Degrees	ALL OVER PRODUCT		

You will need to wet lay on your carbon fibre piece to do this get two cups one for resin and the other to calculate the weight of the materials for the right resin to hardener ratio. The resin ratio will be shown on the tub that it came from. Place your carbon fibre between a layer of release film (Red) ready for the resin to be applied. Using the ratio given, begin to mix your resin and hardener (Slow) for two minutes.

Once done peel back the top layer release film and pour out the resin. Place the release film back on top. Then use a Lolly Pop Stick to move the resin around the material. When the material is covered fully in resin place it in the mould (if there is one provided) or on top of one of your Core Material.

After this debulk.

Repeat this method two more times then again debulk, with your final carbon layer then after ready to be cure. You can repeat this method because you can use the same amount of resin for each layer of carbon fibre as the weight would stay the same. You can use the table above to know when to debulk and when each layer is applied.

Repeat all the states above again for your other Win Assembly.

You should now have two separate pieces of your Wing Assembly; you need to bag this ready to be cured it should be layered in order:

STEP No	MATERIAL ORDER	TICK WHEN DONE
1	Part	
2	Peel Ply	
3	Perforated Release Film (Blue)	
4	Breather Fabric	
5	Bag	

Once bagged put under vacuum then use any excess bag around the edges of your part ready to be cured in the oven. Curing will take anywhere from 3 to 4 hours.

After curing remove your parts from the bag, this is time where you can sand back any sharp edges on your part to make it safe to handle. Once all sharp edges are removed you need to fuse the two parts together using glue. To do this sand the bottom of each part to make it less smooth and more ruff. This will make a stronger bond between the Upper Core Material and the Lower Core Material. When complete add the glue to both surfaces and use a lolly pop stick to evenly spread the glue around to the edges of both parts then stick together.

Afterwords you have successfully completed your Wing Assembly.

Task 2A Preparing the mould

Assessment number (eg 1234-033)	8713-333
Assessment title	Composites Technologies Occupational Specialism

Candidate name	<first name> <surname>
City & Guilds candidate No.	ABC1234

Provider name	<provider name>
City & Guilds provider No.	999999a

Task(s)	2A
Evidence title / description	Prepared mould
Date submitted by candidate	DD/MM/YY

Task 2A

Assessment themes:

- Health and safety
- Planning and preparation
- Production

You must:

- prepare the work area
- prepare the mould
- reinstate the work area.

Additional evidence of your performance that must be captured for marking:

- assessor observation that includes:
    - the prepared work area
    - the mould preparation
    - the preparation of composite materials
    - the work area before, during and on completion of the tasks.
- Photographic evidence which shows:
    - mould preparation
    - preparation of materials
    - work area before, during and on completion of the tasks.

Candidate evidence

2A Preparing the mould

The prepared work area

The candidate put on their PPE including overalls, nitrile gloves and safety glasses. The retrieved 1 off cure plate that had previous cured resin residue on it. Without reference to their method statement, they picked out MC1 Mould cleaner, CR1 mould release. They also obtained a lint free cloth and cut it down to an appropriate size using shears. They additionally picked out a metallic window scraper.

Figure 1 - Cutting of lint free cloth

Figure 2 - Selected Chemicals

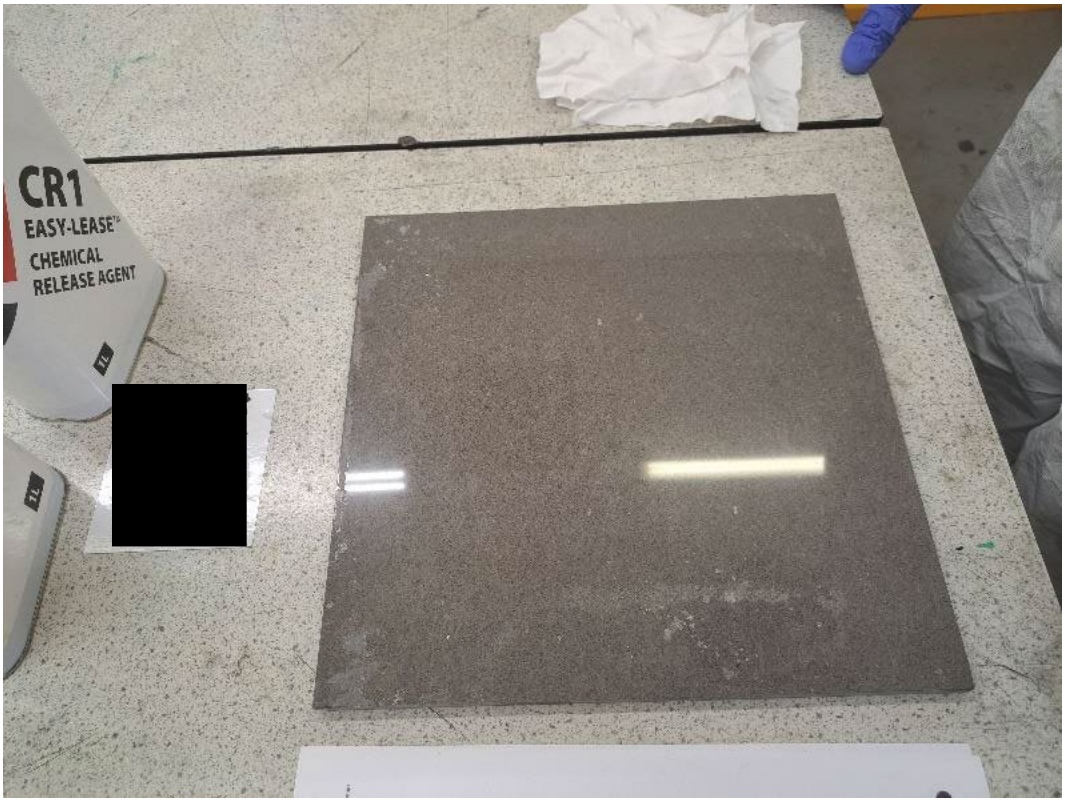


Figure 3 - Defects on mould

The mould preparation

Still with no reference to their method statement, the candidate inspected the mould tool for obvious defects. When satisfied, they scraped off all the old residue from the mould. They then cleaned the mould tool with MC1 cleaner leaving 5mins to flash off based off of previous experience not relating to method statement or relevant data sheet.

They then applied multiple coats of release agents leaving approximately 5mins between coats once again relying on previous knowledge rather than checking any paperwork. During one of the flashing off periods, they reviewed their method statement and then picked up a second cure plate and followed the same inspection, cleaning and releasing phase.

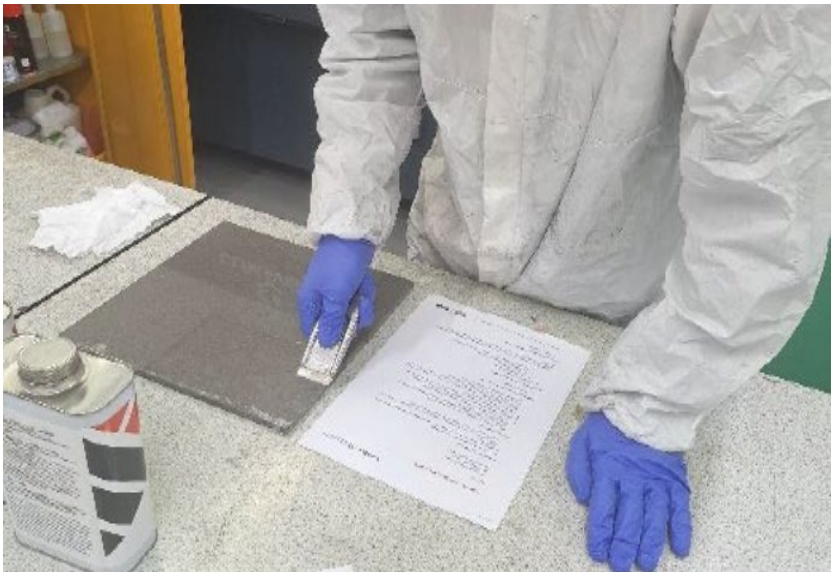


Figure 4 - Cleaning of mould tool

Figure 5 - Application of release agent

The work area during and on completion of the tasks

During the mould preparation, the candidate's work area was tidy and well organised. Upon completion of the preparation, all chemicals were return to the COSHH cabinet and all cloths

disposed of. Shears and the scraper were left out neatly next to the mould tools along with the production paperwork.

Figure 6 - Work area during task

Figure 7 - Work area after task

The preparation of composite materials

N/A for this task

Task 2B Production of the wing section components

Assessment number (eg 1234-033)	8713-333
Assessment title	Composites Technologies Occupational Specialism

Candidate name	<first name> <surname>
City & Guilds candidate No.	ABC1234

Provider name	<provider name>
City & Guilds provider No.	999999a

Task(s)	2B
Evidence title / description	The completed wing section
Date submitted by candidate	DD/MM/YY

Task 2B

Assessment themes:

- Health and safety
- Production
- Quality review and evaluation

You must:

- prepare the work area for the laying up activities
- construct the wing section components (lower, core and upper) demonstrating:
    - marking out and cutting materials
    - laying up
    - curing
    - demoulding
- re-instate the work area.

Additional evidence of your performance that must be captured for marking:

- assessor observation of:
    - production of the wing section components to include
        - the handling and application of composite materials
        - the application and use of tools and equipment
        - the work area before, during and on completion of the tasks
    - the finished (demoulded and cured) wing section components.
- Photographic evidence which shows:
    - marking out and cutting materials
    - the laying up and consolidation process
    - the curing process
    - the demoulding process and the finished (demoulded and cured) wing section components
    - the work area before, during and on completion of the task.

Candidate evidence

2B Production of the components

The production of the wing section components

After reading the brief, the candidate put on nitrile gloves and coveralls on before handling the foam material. Without reference to the method statement the candidate picked up a steel rule and chinagraph pencil to mark out rectangles in the foam. The chinagraph showed the line but not as clearly as other methods (sharpie / biro). They picked the thicker available foam for both the upper and lower core sections (expected thick for upper, thin for lower).

Starting with the upper core, the candidate used a scalpel blade, sometimes in a dagger like approach, to partially cut through the foam. When deemed deep enough, the candidate snapped the remaining foam by leaning on it but the subsequent shatter line came inside their cut line rendering the core unusable. A second rectangle was marked out and cut in the same manner but did not come undersized when snapped. A side profile of the wing was drawn on the foam using a chinagraph pencil. Initially placing the cut foam on a wooden block on top of a downdraft bench, the candidate used an abrasive block to sand down the core while wearing, cut proof gloves, coveralls and an FFP3 mask. After a while, they switched across to a small palm sander, ensuring oil was first added before attaching the air line. Before using the sander they also put on a pair of safety goggles to the previously mentioned PPE. Frequent checks to the jigs were done throughout the process.

For the lower core, a linisher was used to remove most the material of the core then a mixture of sanding block and palm sander used for the finer material removal. The cores generally had a good surface finish and profile to them. The lower core had more of a step on the trailing edge rather than a feather edge. Once the foam was completed, all tools were returned to the relevant areas / cupboards.

Wearing nitrile gloves and coveralls, the candidate marked out plies on the carbon plain weave material. This was not stated in their method statement and was likely used as it was already out and being used by other candidates. No reference their own method statement was seen but the candidate did refer to the relevant drawings in the brief for ply sizes. Masking tape was applied to the material and using a steel rule / biro, the sizes were marked out on this tape. The material was then cut using a pair of shears leaving some of the masking tape on the live ply. The candidate used a set square to orientate the 45° plies.

Once all plies were cut, a pile for each orientation was created and placed in front of the work area.

The candidate prepared 2 mixing cups, a brush and tongue depressor for the layup activity. Additionally they cut some vacuum bag and cut it into squares slightly larger than the plies. They also added safety glasses to the coveralls / nitrile gloves they were already wearing. The candidate pick EL2 resin with AT30 Fast hardener without any reference to their method statement. This was likely picked as it had been left out / used by other candidates. The candidate measured out the resin ratios as stated on the side of the bottle After mixing, they applied the resin to the fibre while sandwiched in between 2 vacuum bag squares in line with the “glaminating” or “fake prepreg” method. Each ply was wetted out individually, placed onto the core and rolled down with a paddle roller. Before the first ply, the foam was painted with resin. The plies on the upper core did not come full round the core but were approx. 3mm short.

Once all plies were added to one core, peel ply and solid release film were cut oversize to the part and applied. A large piece of breather was cut and wrapped around the part. A large piece of vacuum bag was cut and taken to a bench away from sharps / resins to have tacky tape applied to create an envelope bag. The breather wrapped part was brought to the bag and sealed before being taken to a vacuum port. The initial bag had a leak when tested so the candidate rebagged the first part. The rebagged part had good excess on female radii and no excess on male radii. The lower core plies were laid up in the same manner with a fresh mix of resin, bagged up in the same manner with no need to rebag. During the above foam shaping, laminating and bagging steps, the method statement was never referred to.

The candidate requested a cure cycle of 300°C for 4 hours without reference to the supplier’s technical data sheets (TDS) or their own method statement. When asked if they were happy with that cure cycle, they looked at the TDS and asked for the parts to be left at room temperature overnight.

During the demoulding, the candidate put on coveralls, cut proof gloves and glasses. They carefully removed the consumables and left them on the table while they demoulded. Using plastic wedges, they demoulded the part from the mould surface. The mould was then cleaned from excess flash and returned to the storage area. Both sections had resin bleed under the foam core as expected. All tools / wedges were returned to the appropriate areas.

Figure 8 - Marking out of foam

Figure 9 - Cutting of foam

Figure 10 - Measuring of core profile

Figure 11 - Using linisher

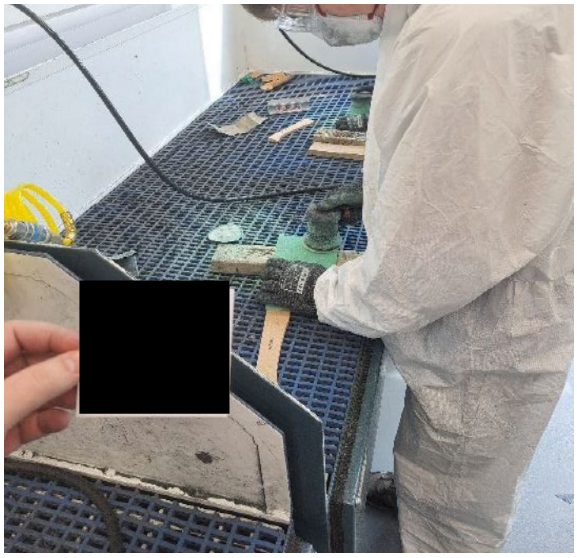


Figure 12 - Shaping core / PPE

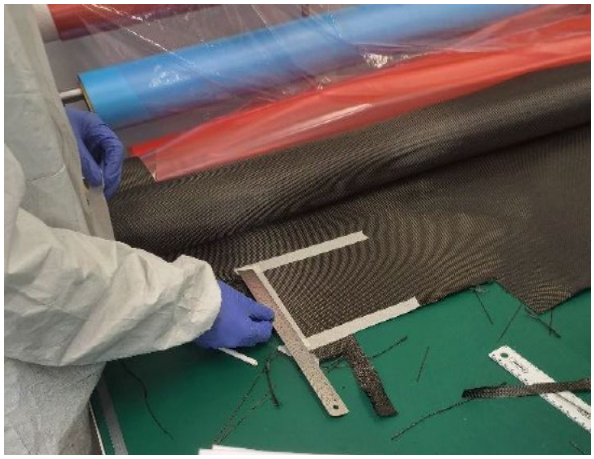


Figure 13 - Marking of dry fibres

Figure 14 - Cutting dry fibres

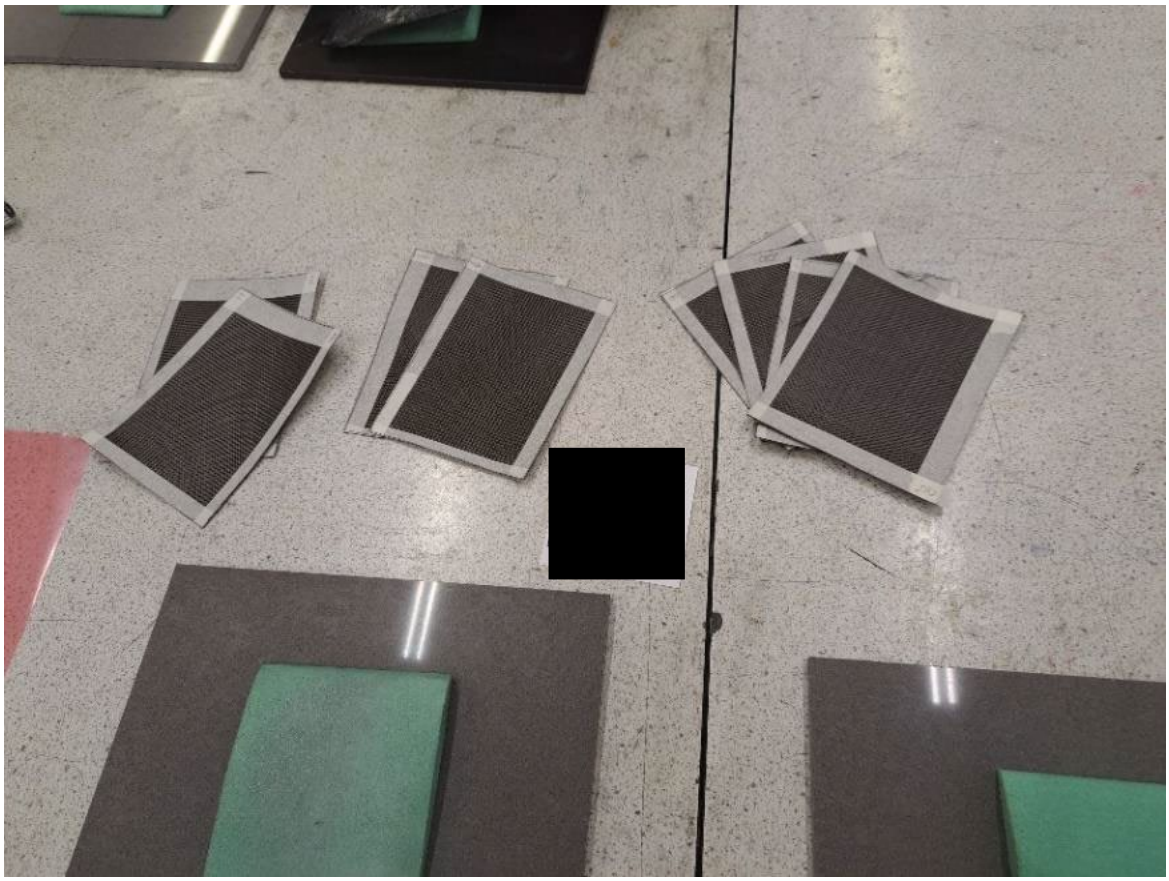


Figure 15 - Cut plies

Figure 16 - Resin Material Selection

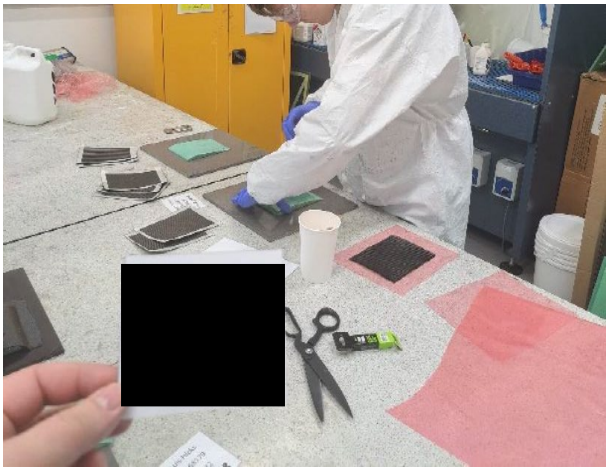


Figure 17 - Painting resin onto core

Figure 18 - Wetting out fibres

Figure 19 - Application of consumables

Figure 20 - Final vacuum bag

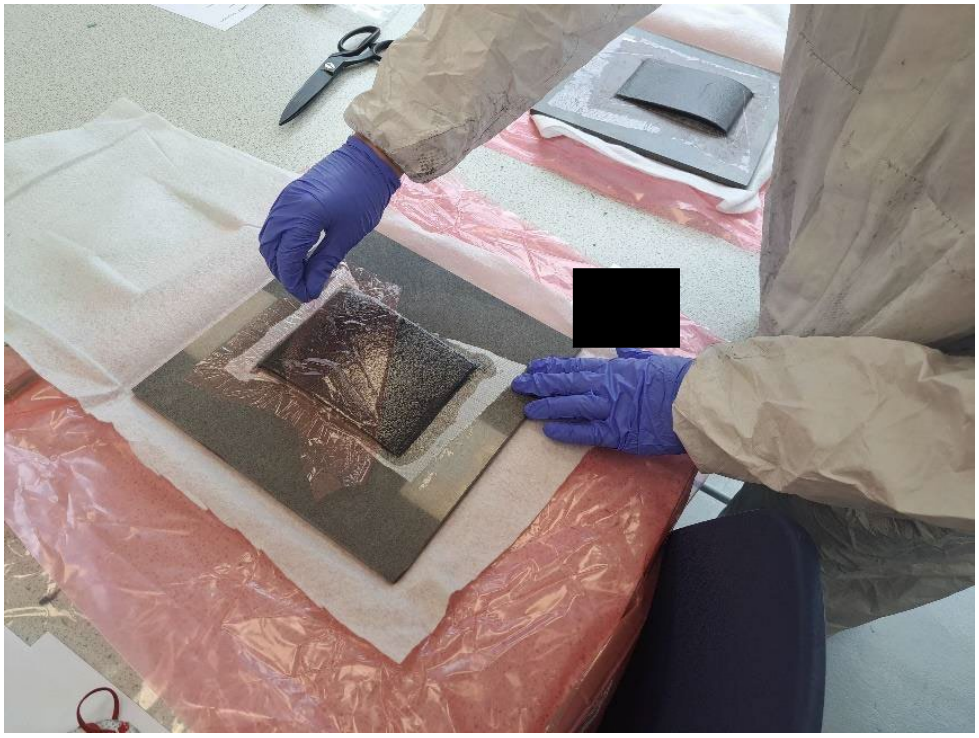


Figure 21 - Removal of consumables

Figure 22 - Demoulding Component

The work area during and on completion of the tasks

During the core manufacturing stage, the candidate's work area was well organised. As their core manufacture went in to the second day, the candidate ensured the work area was safe and tidy before leaving for the day. Once core manufacture had finished, the work area was left clean and tidy.

The work area during layup was well organised however no protective film was placed underneath the work area to catch any excess resin drips. Some of these were noted during the process but the candidate cleaned these up at the end of the layup section. The ply cutting area was left with shears out on the side and lots of loose fibres. This was from not one but all of the candidates on the assessment.

During the layup stage, a near empty cup of resin was placed into the general waste bin and not placed in the COSHH waste area to cure off as per standard process.

At the end of demoulding, the work area was clean and tidy with components / jigs well organised for the next day.

Figure 23 - Work area during core manufacture

Figure 24 - Work area during core manufacture

Figure 25 - Work area at end of day 1

Figure 26 - Work area at end of day 1

Figure 27 - Work area during laminating

Figure 28 - Work area at end of laminating / core stage

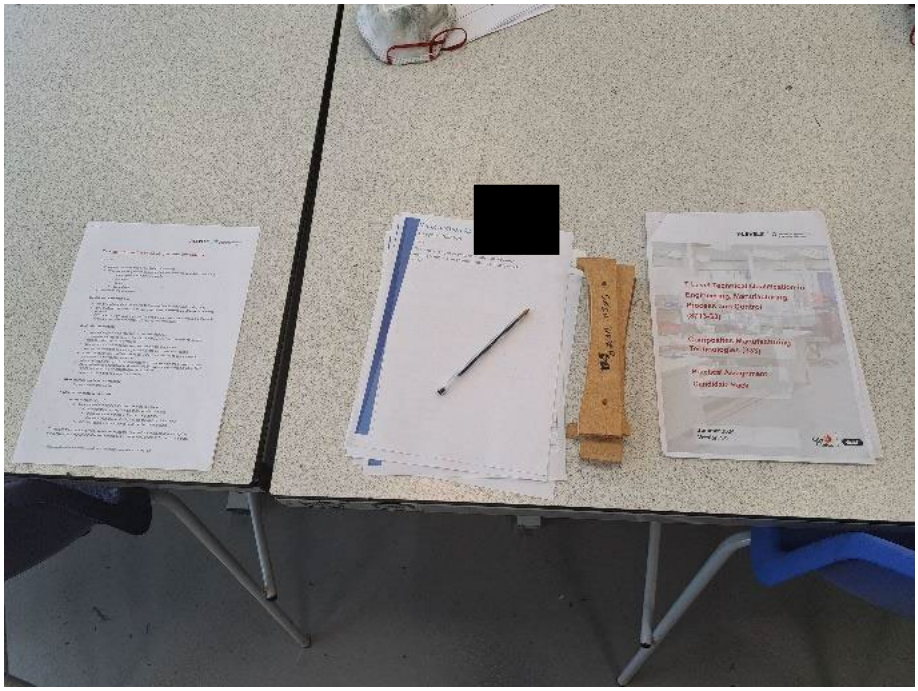


Figure 29 - Work area at end of laminating / core stage

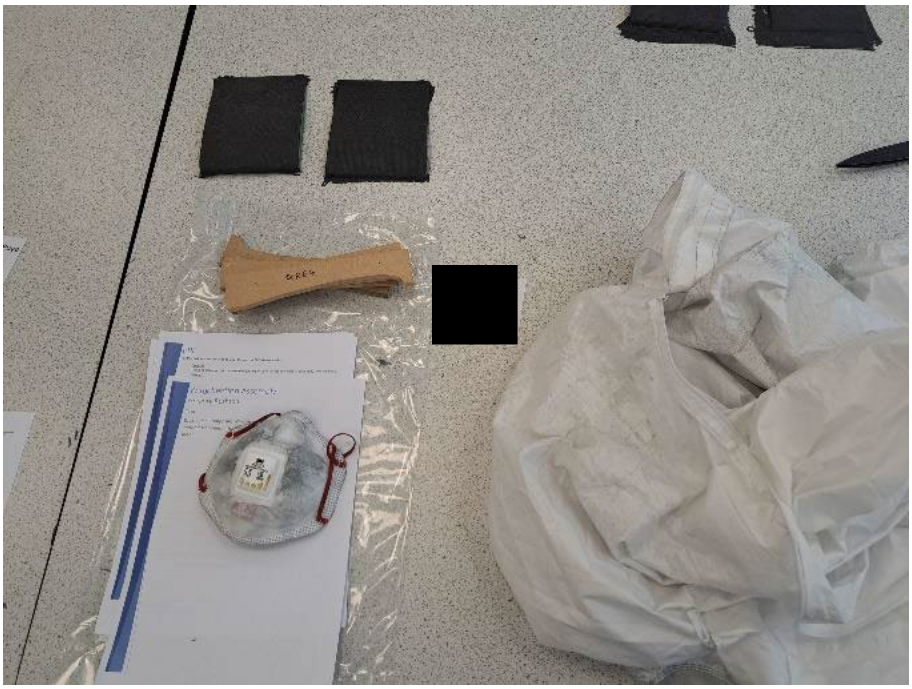


Figure 30 - Work area at end of Task 2B

The finished (demoulded and cured) wing section components.

Both parts were fully cured. As mentioned previously, the plies on the upper core were short by approximately 3mm showing exposed core. The edges of the plies had some of the 0° fibres missing where the weave had separated and the tows had been pulled out. Both cores had material coming down the edge of the parts. Additionally, both sections had some resin bleed under the core as expected.

Figure 31 - Cured components – Top

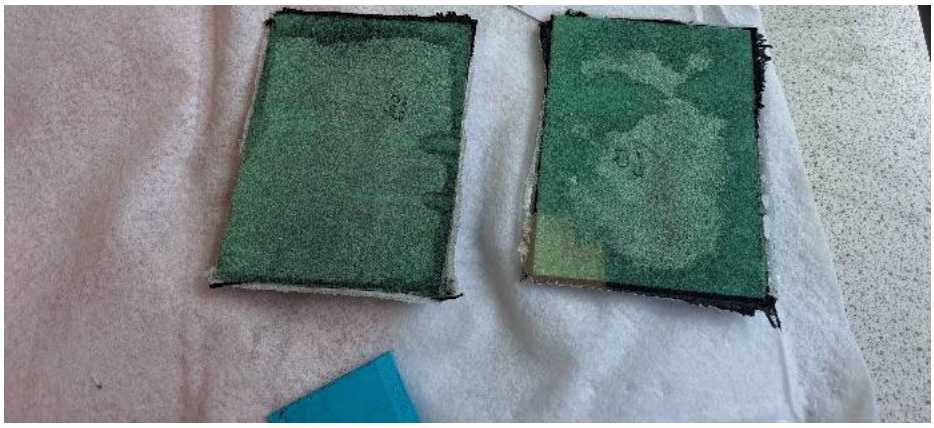


Figure 32 - Cured Components - Base

Task 2C Assembly

Assessment number (eg 1234-033)	8713-333
Assessment title	Composites Technologies Occupational Specialism

Candidate name	<first name> <surname>
City & Guilds candidate No.	ABC1234

Provider name	<provider name>
City & Guilds provider No.	999999a

Task(s)	2C
Evidence title / description	The completed wing section assembly
Date submitted by candidate	DD/MM/YY

Task 2C

Assessment themes:

- Health and safety
- Production
- Quality review and evaluation

You must:

- prepare the work area for the assembly activities
- complete the wing section assembly, demonstrating:
    - the bonding process
    - the curing process
    - the trimming and finishing process.

Additional evidence of your performance that must be captured for marking:

- assessor observation of:
    - assembly of the wing section in stages, including bonding, curing, trimming and finishing processes
    - the completed wing section assembly
    - the handling and application of composite materials
    - the application and use of tools and equipment
    - work area before, during and on completion of the tasks.
- Photographic evidence which shows:
    - assembly of the wing section in stages, including bonding, curing, trimming and finishing processes
    - the completed wing section assembly
    - the work area before, during and on completion of the task.

Candidate evidence

2C Assembly

Trimming

After reading the brief, the candidate put on coveralls, cut proof gloves, safety glasses and an FFP3 mask. Above a downdraft bench, they put one half of the assembly onto a wooden block to raise it up and abraded back the edges using a permagrit block. This was done until the edges were square. No use of the skin checking jigs were seen and no reference was made to either their method statement or the main brief.

Figure 33 - Trimming using permagrit block

Figure 34 - Trimming using permagrit block

Bonding / Curing

Once the parts were abraded back, the candidate cut some vacuum bag to work on top of, as well as prepared a tongue depressor, adhesive and applicator gun. The applicator initially came with ET515 adhesive but the candidate switched this to ET 538. Either adhesive was suitable however 515 would have been better due to its shorter handling time.

The candidate put on their PPE consisting of coveralls, safety glasses and nitrile gloves. The adhesive was applied in a zig-zag pattern before being spread over the component. The adhesive was fairly thin and in some areas did not reach the very edge of the component.

The two halves were aligned by eye and flash tape was used to hold the two sections together. Once together, the candidate looked at the TDS and decided to leave the part to cure in the open air with not heat applied.

Figure 35 - Application of adhesive

Figure 36 - Spreading adhesive

Figure 37 - Bonding Assembly

Finishing

No post adhesive application finishing was carried out.

Final Component

The final component has a textured peel ply surface finish on both sides. Some plies, adhesive and resin are still present on the edges of the core. A gap on the leading edge (varying between 3 and 5mm) is present with exposed core showing. The edges of the flat surface of both cores is rounded leaving a 1mm indent on both edges on the final component. The trailing edge has a 3mm step on it with some exposed core. Both the top and bottom surface had spots of excess adhesive / resin on. The chord length of the wing is 163mm, width is 122 and there is poor conformance to both upper and lower jigs.

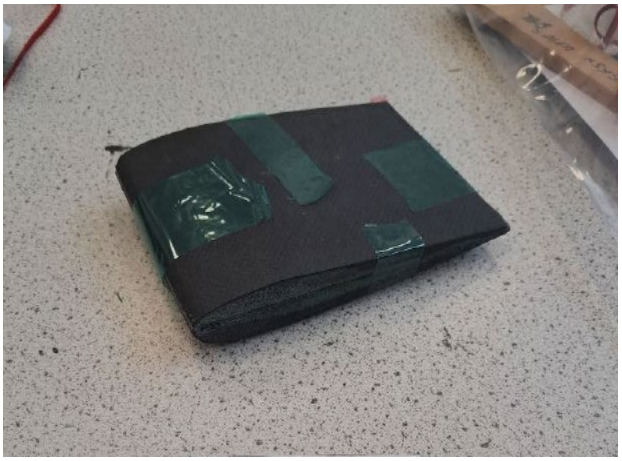


Figure 38 - Final Component

Work area during and on completion of tasks

After each section of this task, the work area was appropriately tided with all tools being returned and WIP components left in a neat pile.

During the bonding exercise, the work area was protected but at times became messy. This was in part to the candidate and in part to those working around them.

Figure 39 - Work area during bonding

Figure 40 - Work area after bonding

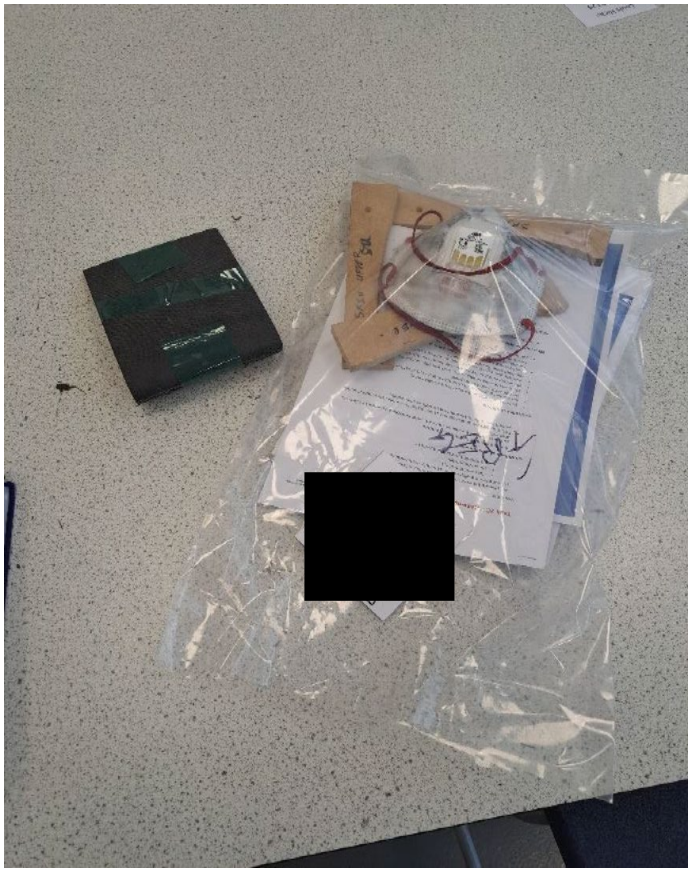


Figure 41 - Work area at the end to Task 2C

Task 3A Defect identification

Assessment number (eg 1234-033)	8713-333
Assessment title	Composites Technologies Occupational Specialism

Candidate name	<first name> <surname>
City & Guilds candidate No.	ABC1234

Provider name	<provider name>
City & Guilds provider No.	999999a

Task(s)	3A
Evidence title / description	List of identified defects with cause and prevention indicated
Date submitted by candidate	DD/MM/YY

Task 3A

Assessment themes:

- Quality review and evaluation

You must:

- carry out a defect identification inspection
- suggest processes that should be introduced or modified to prevent defects

Additional evidence of your performance that must be captured for marking:

- assessor observation that includes:
    - defect identification process.
- Photographic evidence which shows:
    - the defect identification process being undertaken.

Candidate evidence

3A Defect identification

Sample number given – Sample B

Measurement process

The candidate used a steel rule and profile jigs to conduct measurements..

Pre-defined defects identified

- air bubble of lower section

- cores misaligned

- black FOD in glass on lower

- release film left between layers

- lower core too short on training edge

Defects missed

-

- material short at leading edge

- lower section short of resin

- chord 164mm

- upper and lower profile not great

Additional defects stated

- Resin rich regions

- Wrinkles in CSM (material was twill)

- One side peel ply, one side not (incorrect, this was a dry side not peel ply texture)

- Pin holes (not present)

- Voids (not present)

Reason for occurrence

Reasons are basic and some are incorrect entirely.

Future recommendations

Most recommendations are good with a few that are basic.

Task 3A – Defect Identification

Task

Carry out a defect identification inspection of a prefabricated defect ample assembly, as well as how to prevent them from occurring.

Defect Inspection Sample B

‘Sample B’ is a model of the Wing Section after cured and layup process. The sample uses the same process that I went through however uses chopped strand matt rather than carbon fiber. The part has a lot of noticeable defects which are as follows:

Blisters

On the lower wing assembly there is a noticeable blister where the fabric has not correctly bonded to the core material. This was likely caused by the fabric being stretched or pulled during the layup process and as the part was curing the fabric remained in the outstretched portion. To prevent this, you need to be less aggressive when using a brush and a roller to remove any air pockets within the fabric or misplaced fabric.

Resin Rich Areas

On the surface of the part there is a lot of resin rich areas where too much resin has been used to during the wet lay process. You can see this where lines have formed where the resin wasn’t spread evenly around the fabric. To prevent this, you can use smaller quantities of resin for each layer of fabric, use a roller or a lolly pop stick to spread the resin evenly to a less resin rich area, measure out the exact quantity of resin for all your fabric.

Core Misalignment

The core material (foam) has been incorrectly bonded together and is off center therefore the edges overlap one another which doesn’t meet the brief. One core also has greater length to the other other the part could not sit perfectly onto of each other. To prevent this from happening you can use a flat surface to align the part or a 90-degree triangle so both cores can sit flush.

Lose Material

Release film (red) can be seen in between the middle of both cores over hanging the part as well as lose fibres or chopped strand matt that have shape edges and can easily fall apart. This makes the part look messy and the overall appearance worse. To stop this, I would recommend cutting each material to the size of the core, so you have no loose (overhanging fabric. Try and not pull at any strands in the fabric and cut out your material slowly so your scissors don't rip your fabric.

Foreign Object Debre

Foreign Object Debre (or FOD) is where some fibres or materials end up in between your layers when laying up and in 'sample B' there are several black markings that indicate that fibres have gotten in the part when they were not supposed to. Ways to prevent this are, keeping your workplace clean so no small fibres can get into your part. Clean your tools you have used and change into a new set of gloves.

Make both sides identical!

I have noticed that on 'sample B' this part has one side with peel ply and on side without peel ply. This gives on side of the part a nice smooth surface and the other a ruff raged surface. So, you don't forget to use peel ply on both cored you can use a tick sheet to remind you or read through the job card so that you have done each step correctly.

Voids

Voids can be seen on the side of the part where the resin has run off the material during the layup process, voids are air is trapped inside the material leaving small indents in the part or pop when being cured. To stop voids from occurring make sure that every area has no air in it with an even coating of resin. You can also use a roller to move the resin to parts that have less resin in them.

Pin Holes

Although they are very hard to see, pin holes are small holes no bigger than a pin and can form very easily when the fibres overlap. Pin holes are very hard to prevent however they can be reduced if you use peel ply and lots of resin.

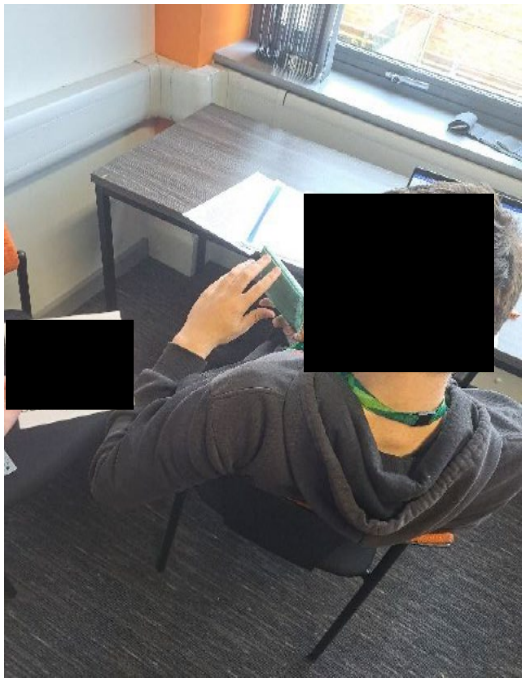


Figure 42 - Visual Inspection of Defect Sample

Task 3B Quality review and recording

Assessment number (eg 1234-033)	8713-333
Assessment title	Composites Technologies Occupational Specialism

Candidate name	<first name> <surname>
City & Guilds candidate No.	ABC1234

Provider name	<provider name>
City & Guilds provider No.	999999a

Task(s)	3B
Evidence title / description	Completed quality check sheet Quality inspection report
Date submitted by candidate	DD/MM/YY

Task 3B

Assessment themes:

- Quality review and evaluation

You must:

- perform quality assurance checks on their finished assembly
- produce an inspection report evaluating the production of their finished assembly.

Additional evidence of your performance that must be captured for marking:

- assessor observation that includes:
  - quality checking process
  - application of measuring equipment.
- Photographic evidence which shows:
  - the quality checking process being undertaken and the use of the quality check sheet.

Candidate evidence

3B Quality Review

The candidate used a steel rule, vernier and checking jigs to inspect their component. No mention of checking calibration made in the report. A checking list wasn't made in task 1 but one was created here and filled out electronically. Checking list was basic and didn't have many typical quality inspection points.

Lengths measured were correct, stated that plies cover entire surface when they are short at the leading edge.

Their recap of the process they used was accurate No real evaluation of manufacturing technique undertaken but deemed that their overall process was a good way to manufacture the wing.

Generally good and technical language used throughout.

Task 3B – Quality Review and Recording

Task:

Perform quality assurance checks on the finished assembly, produce inspection report, with a list that must include evaluations of the part.

Brief	Was Brief Completed	Did the part meet the brief	If not, why? How to prevent this from happening.
The Core must be 170mm in length	Yes	No Measured 162mm	My part only measures up to a length of 162mm because I sanded the core too much to fit in the mould shape. To prevent this, I should pay more attention when sanding down my Core, so it meets the brief.

The Core must be 120mm in width	Yes	Yes Measured 122mm	My part is slightly bigger than the brief however it fits within the 0.2 tolerance.
There must be 4 layers of ply arranged at: 90, +45, -45, 90 degrees.	Yes	Yes Each layer is on the part and is correctly orientated.	
The ply must cover the whole of the part.	Yes	Yes The ply covers the whole part.	
Both Cores must be bonded together.	Yes	Yes Both Cores are bonded.	
The part must fit in the ‘skin upper’ and ‘core upper’ mould.	Yes	Yes My ‘skin upper’ and ‘core upper’ fits in the mould.	
The part must fit in the ‘skin lower’ and ‘core lower’ mould.	Yes	No The part does not fit within the mould.	The back of the ‘skin lower’ mould sits elevated on the part not flush. Therefore, the part does not fit within the mould dimensions. To prevent this, I need to focus on the areas that catch on the mould and only sand down those parts.

Inspection report

Method of Production

How I produce my Win Section Assembly:

- Clean and release two slabs using mould cleaner and acetone.

- Collect foam sheet that is bigger than the mould in width, hight and length.
- Using a scapple cut the foam so that it is half a centimetre bigger than the mould.
- Use a sanding block to create a curve if the foam so it matches the mould gap.
- Then cut out your carbon fibre in this orientation: 90, -45, +45, 90.
- Cut them out with a width of 125mm and a length of 175mm.
- Repeat the last two steps again.
- Get a cardboard cup and weigh your material, once weighed divide your material weight by the number of pieces you must use for a resin ratio. It should come to a 10:3 resin to hardener ratio.
- Cut some bag to place your material in.
- Using that ratio, mix your resin and hardener together with a lolly pop stick and a cardboard cup for two minutes.
- Place your material in between the bag you cut out then place your mixed resin on top.
- Fold the bag over the top of the material and resin.
- Use a new lolly pop stick to spread the resin over the material.
- When covered place your material on your core.
- Repeat this process three more times using the carbon fibre orientation.
- Cut out breather, release film (red), peel ply, bag and tacky tape to go other your part.
- Your breather and bag need to go around the whole of your part including the slab you cleaned earlier. Your peel ply and release film need to go over the core.
- Place the core in the middle of the slab and then place a layer of peel ply on top, after comes the release film, surround the part and slab in breather.
- Place in your bag then seal with tacky tap.
- Debulk your part making sure there is no leaks or bridges.
- Repeat this process with your first core with your other core.
- Then leave on the side to core for around 24 hours.
- Once cured pop your parts from the slab.
- Sand down any sharp edges then trim your part to size. (120mm width and 170mm length)
- Begin to ruff up the underside of your cored ready to be bonded.
- Use a glue gun and a lolly pop stick to cover the surface of both cores.
- Stick both cores together.
- Use tape to hold part together when curing.
- Leave to cure for 4 hours.

- Once cured remove tape and you have finished making your wing assembly.

Would I change anything about my method statement?

I wouldn't change anything about my method statement as the overall process is accurate to make a Wing Assembly as the mistakes that I made wasn't down to my method statement more individual error. However, I would have liked to of gone into more detail in my method statement as is can be quite hard to follow so in the future, I would add more detailed and descripted words to help during the manufacturing process. However I was able to follow by method statement and I didn't have to change my process at any point during manufacturing.

Quality Checks

During the manufacturing process I made sure to do inspections on my part during every process to ensure each step was gone correctly. Within these check ups I looked for mistakes I made or damage to the part that may affect Wing Assembly. The reason why I did quality checks was to ensure that my part would be as good as possible so no defects could damage my part. There are still however defects in my part, the main being pin holes on the surface of the carbon fibre however these are limited. As are voids which are also on the surface of the carbon fibre but once again there are only a few. To prevent these from recurring I will use a roller to get rid of any air pockets that might get trapped when I am laying up my carbon fibre. I would also tick off what I've done in my method statement to remind myself that I had done them so I wouldn't repeat what I was doing again which could lead to error.

Is the Wing Assembly Fit for Purpose

Unfortunately the wing Assembly is now fit for purpose as there are some points that don't meet the brief. Such as, the length of the part and the lower skin that doesn't fit between the mould. The rest of the part does match the brief and the part doesn't have any damage not defects that structurally weaken the wing therefore my part would be fit for purpose.

Any improvements I would make.

The improvements I would make to my final piece is to use a larger Wing Upper and Lower Skin because there are areas where my carbon fibre doesn't cover the whole of the part leaving the core exposed. Therefore, I would increase the size of the Wing Skin

on both cored then trim them down after they cured. I would also use a smaller piece of foam for my core as I spent a lot of time trimming it down to size and it would have made it easier to fit in the mould.

Final Thoughts

Am overall very happy with how my final part has come out and all though I didn't manage to meet every brief I made a wing assembly that matches the description of the brief with little to no defect present.

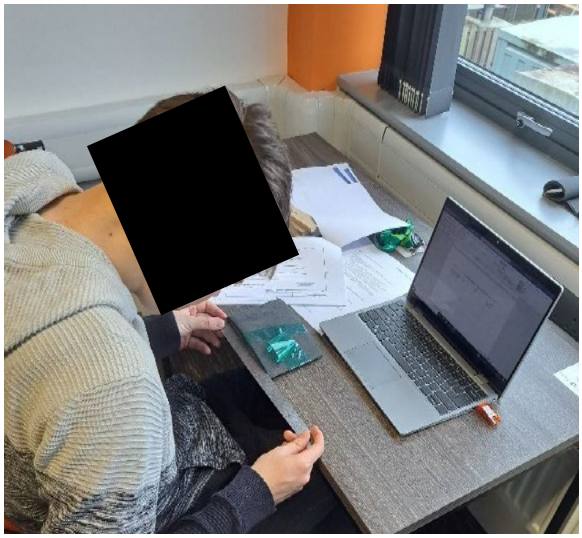


Figure 43 - Inspection of final component

Task 3C Handover

Assessment number (eg 1234-033)	8713-333
Assessment title	Composites Technologies Occupational Specialism

Candidate name	<first name> <surname>
City & Guilds candidate No.	ABC1234

Provider name	<provider name>
City & Guilds provider No.	999999a

Task(s)	3C
Evidence title / description	Assessor observation of handover meeting
Date submitted by candidate	DD/MM/YY

Task 3C

Assessment themes:

- Quality review and evaluation

You must:

- hold a meeting with the supervisor to complete handover procedures

Additional evidence of your performance that must be captured for marking:

- assessor observation that includes:
    - quality inspection report
    - the completed wing section assembly
- Video evidence which shows:
    - the handover meeting being undertaken.

Candidate evidence

3C Handover meeting

Handover was relatively brief with some detail in it. Some logic to presentation and generally good terminology used throughout.

Get in touch

The City & Guilds Quality team are here to answer any queries you may have regarding your T Level Technical Qualification delivery.

Should you require assistance, please contact us using the details below:

Monday - Friday | 08:30 - 17:00 GMT

T: 0300 303 53 52

E: **technicals.quality@cityandguilds.com**

W: **http://www.cityandguilds.com/tlevels**

Web chat available **here**.

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